

## REVIEW

# Perioperative and periprocedural airway management and respiratory safety for the obese patient: 2016 SIAARTI Consensus

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## ABSTRACT

Proper management of obese patients requires a team vision and appropriate behaviors by all health care providers in hospital. Specialist competencies are fundamental, as are specific clinical pathways and good clinical practices designed to deal with patients whose Body Mass Index (BMI) is  $\geq 30$  kg/m<sup>2</sup>. Standards of care for bariatric and non-bariatric surgery and for the critical care management of this population exist but are not well defined nor clearly followed in every hospital. Thus every anesthesiologist is likely to deal with this challenging population.

Obesity is a multisystem, chronic, proinflammatory disorder. Unfortunately many countries are facing a marked increase in the obese population, defined as "globesity". Obesity presents an added risk in hospital, leading health care organizations to call for action to avoid adverse events and preventable complications. Periprocedural assessment and critical care strategies designed specifically for obese patients are crucial for reducing morbidity and mortality during surgery and in emergency settings, critical care and other particular settings (e.g., obstetrics). Specific care is needed for airway management, as are proactive strategies to reduce the risk of cardiovascular, endocrine, metabolic and infective complications; any effort can be fruitful, including special attention to the science of human factors.

Endorsed by: SIAARTI (*Società Italiana di Anestesia, Analgesia, Rianimazione e Terapia Intensiva*) Research and Scientific Production Committee; EAMS (European Airway Management Society); ESPCOP (European Society for Perioperative Care of the Obese Patient).

The global obesity epidemic is having a major impact on the provision of health care. In particular, the hospitalization of obese patients is challenging and requires novel ap-

The Italian Society of Anesthesia, Analgesia, Resuscitation and Intensive Care (SIAARTI) organized a consensus project involving other national scientific societies to increase risk awareness, define the best multidisciplinary approach for treating obese patients in election and emergency, and enable every hospital to provide appropriate levels of care and good clinical practices. The Obesity Project Task Force, a section of the SIAARTI Airway Management Study Group, used a formal consensus process to identify a series of notes, alerts and statements, to be adopted as bundles, to define appropriate clinical pathways for hospitalized obese patients. The consensus, approved by the Task Force and endorsed by several European scientific societies actively operating in this field, is presented herein.

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**Key words:** Obesity - Perioperative care - Critical care - Patient safety - Clinical pathways.

proaches in risk assessment and safety strategies. The need to face the “globesity” challenge should stimulate national health care systems to improve risk management and safety.

To respond to the expected “globesity” phenomenon in Italy,<sup>1</sup> the Italian Society of Anesthesia, Analgesia, Resuscitation and Intensive Care (SIAARTI) established an Obesity Project Task Force, within the SIAARTI Airway Management Study Group, to carry out a consensus project. The overall aim of the project was to identify good clinical practices (GCPs) and clinical pathways (CPWs) for risk reduction in obese hospitalized patients. In particular, the Task Force aimed to define the best levels of perioperative and periprocedural care for obese patients and the best procedures for anesthesiology, pain management, respiratory care and critical care medicine. In addition, the Task Force considered relevant human factors such as anesthetists’ non-technical skills and crisis management strategies, as suggested by the Helsinki Declaration on Patient Safety in Anaesthesiology.<sup>2</sup>

In order to define GCPs and identify a series of bundles useful to health care providers, a formal consensus process was used, involving SIAARTI delegates, multidisciplinary specialists and consulting stakeholders. This report details the consensus procedure and presents the series of notes, alerts and bundles that emerged from the work. This consensus should help health care professionals in tailoring their clinical practices to obese adult patients.

## Materials and methods

The SIAARTI Board and the Airway Management Study Group proposed a project about the development of a national consensus on “Perioperative and periprocedural airway management and respiratory safety for the obese patient”. The Task Force entrusted with this project comprised ten Italian experts with specific competencies in airway and respiratory management, bariatric surgery and clinical safety. The project proposal was approved by the SIAARTI Research and Scientific Production Committee.

Obesity was defined as a BMI  $\geq 30$  kg/m<sup>2</sup> according to the World Health Organization (WHO) classification (Table I).<sup>3</sup> A literature search was performed in Medline, PubMed and the Cochrane Database of Systematic Reviews using the following search terms: obesity, non-bariatric procedures, airway management, perioperative level of care, prevention of complications, respiratory care, metabolic syndrome, obstructive sleep apnea (OSA), obesity hypoventilation syndrome, enhanced recovery after surgery (ERAS), ramped position, pregnancy, assistance for emergency,

TABLE I.—Classification of obesity in adults based on Body Mass Index (BMI; kg/m<sup>2</sup>), as suggested by the World Health Organization.<sup>3</sup>

BMI	Class
<18.5	Underweight
18.5-24.9	Normal weight
25.0-29.9	Overweight
30.0-34.9	Obese class I
35.0-39.9	Obese class II
$\geq 40.0$	Obese class III (previously “morbid obesity”)

TABLE II.—*Classification of the levels and grades of evidence used to assess the literature (modified from CMACE/RCOG).<sup>5</sup>*

	Description
Level	
1++	High-quality meta-analyses, systematic reviews of randomized controlled trials or randomized controlled trials with a very low risk of bias
1+	Well-conducted meta-analyses, systematic reviews of randomized controlled trials or randomized controlled trials with a low risk of bias
1-	Meta-analyses, systematic reviews of randomized controlled trials or randomized controlled trials with a high risk of bias
2++	High-quality systematic reviews of case-control or cohort studies or high quality case-control or cohort studies with a very low risk of confounding, bias or chance and a high probability that the relationship is causal
2+	Well-conducted case-control or cohort studies with a low risk of confounding, bias or chance and a moderate probability that the relationship is causal
2-	Case-control or cohort studies with a high risk of confounding, bias or chance and a significant risk that the relationship is not causal
3	Non-analytical studies; e.g. case reports, case series
4	Expert opinion/formal consensus
Grade	
A	At least one meta-analysis, systematic reviews or randomized controlled trial rated as 1++ and directly applicable to the target population; or A systematic review of randomized controlled trials or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2++ directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++ or 1+
C	A body of evidence including studies rated as 2+ directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++
D	Evidence level 3 or 4; or extrapolated evidence from studies rated as 2+
Good practice point	Recommended best practice based on the clinical experience of the guideline development group

and pain therapy. Search results were limited to adult humans, and to English and Italian language articles published between January 1991 and September 2016. Meta-analyses, systematic reviews, intervention and observational studies and guidelines were selected if they focused on the perioperative or periprocedural management of obesity or obesity-related complications or on the management of in-hospital emergencies involving obese patients.

The literature search and analysis were performed by all members of the Task Force, and the results were summarized by one of them (Ida Di Giacinto). The level of evidence and the strength of the recommendations in each retrieved article were weighed and graded<sup>4</sup> according to a predefined scheme (Table II).<sup>5</sup>

The consensus procedure started from five main domains related to airway safety and respiratory care of obese patients:

- The challenge of obesity in the hospital
- Preoperative assessment
- Intraoperative care
- Postoperative safety
- Alerts and warnings for special settings.

These five domains were then broken down into a total of 33 questions. Answers to the 33 questions were formulated, together with bundles of GCPs and alerts, and all were rated on 5-point scales according to their importance and feasibility (Table III).<sup>5</sup> The questionnaire was distributed to SIAARTI Council members and contributors, who discussed it using a modified Delphi approach in five phases (Figure 1). The answers were shared during multiple collegial meetings, and the results are expression of the consensus reached (importance and feasibility values were agreed on by >90%

TABLE III.—*The 5-point scale used to rate the bundles and alerts according to their importance and feasibility (modified from CMACE/RCOG).<sup>5</sup>*

Importance scale		Feasibility scale	
1.	Not important	1.	Not at all feasible
2.	Slightly important	2.	Slightly feasible
3.	Moderately important	3.	Moderately feasible
4.	Very important	4.	Very feasible
5.	Extremely important	5.	Extremely feasible
X.	Unable to score due to insufficient knowledge	X.	Unable to score due to insufficient knowledge

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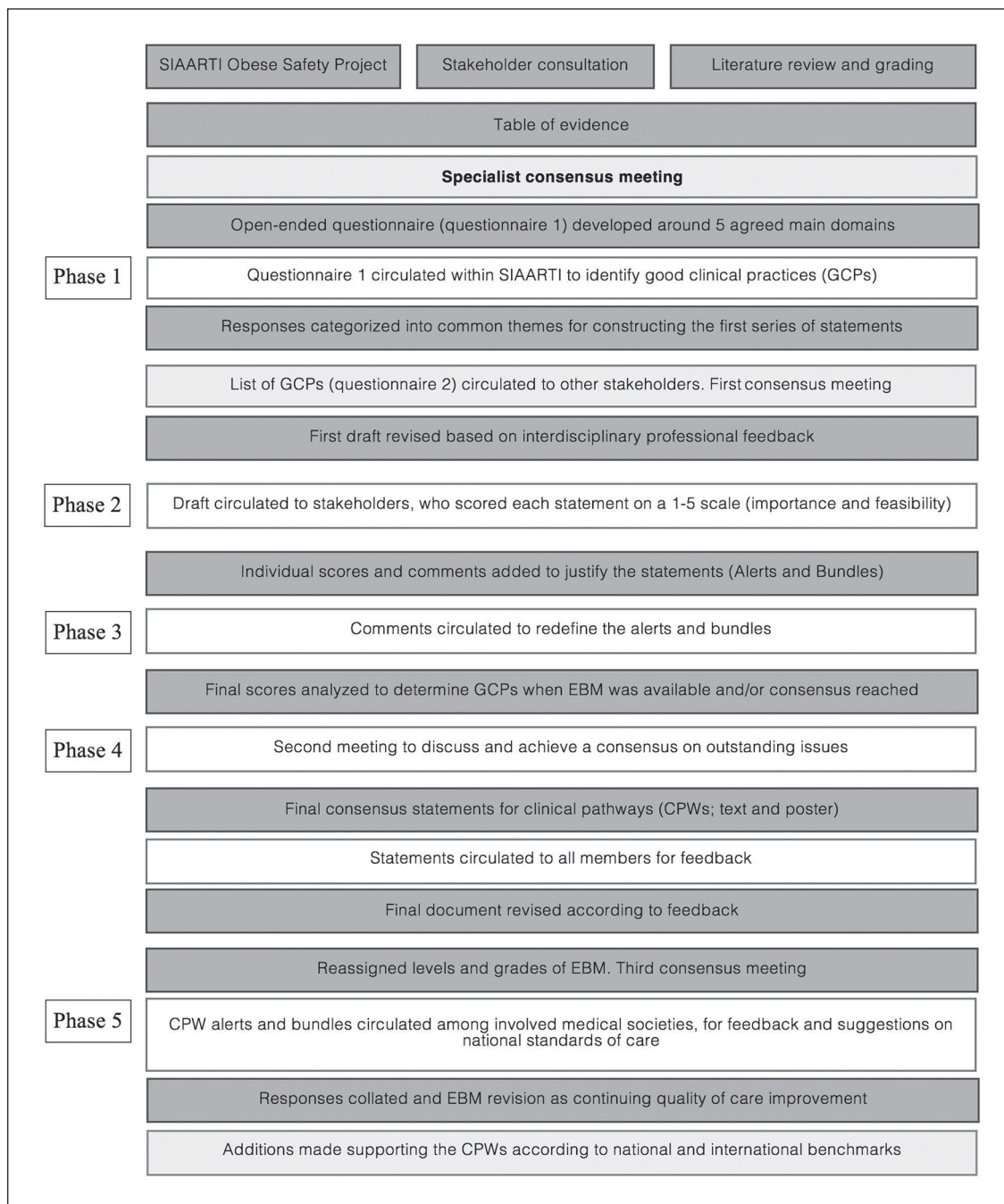


Figure 1.—Process for developing the consensus in perioperative and periprocedural care in obesity, according to a modified Delphi method (modified from CMACE/RCOG).<sup>5</sup>

of the participants in all cases). An additional pool of experts from other scientific societies and professional associations were asked to share their concerns, respond to the question-

naire, and review the proposed bundles. The current article provides, for each of the 33 questions, an answer, an alert and a bundle. On the SIAARTI website ([www.siaarti.it/Pages/](http://www.siaarti.it/Pages/)

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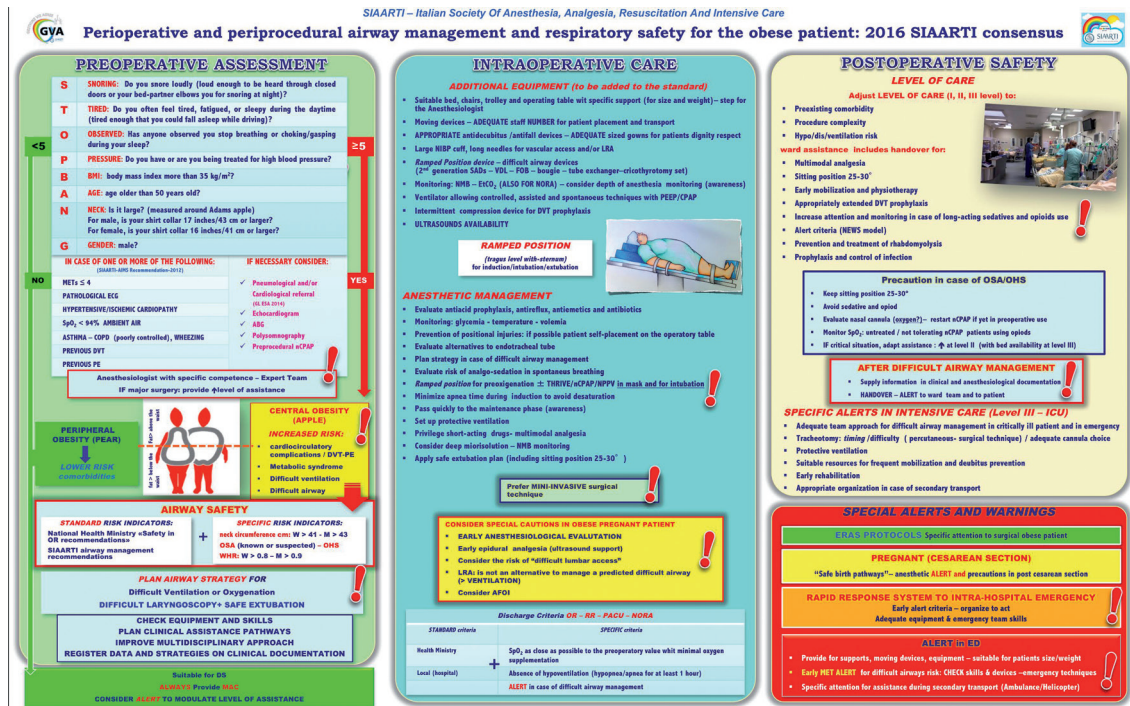


Figure 2.—Poster (see also Supplementary materials in the online version of this article).

ABG: arterial blood gas; ABW: adjusted body weight; AFOI: awake fiberoptic intubation; BMI: body mass index; BP: blood pressure; COPD: chronic obstructive pulmonary disease; DS: day surgery; DVT: deep vein thrombosis; ED: emergency department; ERAS: enhanced recovery after surgery; EtCO<sub>2</sub>: end-tidal carbon dioxide; FOB: fiberoptic bronchoscopy; IBW: ideal body weight; ICU: intensive care unit; LBW: lean body weight; LRA: loco-regional anesthesia; MAC: monitored anesthesia care; METs: metabolic equivalents of task (metabolic equivalents); MET: medical emergency team; nCPAP: non-invasive continuous positive airway pressure; NEWS: national early warning score; NIBP: non-invasive blood pressure; NIV: noninvasive ventilation; NMB: neuromuscular blockade; NPPV: noninvasive positive-pressure ventilation; OR: operating room; OHS: obesity hypoventilation syndrome; OSA: obstructive sleep apnea; PACU: post-anesthesia care unit; PE: pulmonary embolism; PEEP: positive end-expiratory pressure; PONV: postoperative nausea and vomiting; RR: recovery room; TBW: total body weight; SADs: supraglottic airway devices; THRIVE: transnasal humidified rapid-insufflation ventilatory exchange; VDL: videolaryngoscope; WHR: waist-to-hip ratio.

formazione-e-risorse/linee-guida.aspx) three Appendices are freely available to all readers: Appendix 1 contains the relative levels of evidence provided in a “To do and not to do” table, Appendix 2 is a short version of the CPWs in the form of a poster (also available in this paper as Figure 2 and in the Supplementary materials), while Appendix 3 contains the whole body of literature analyzed.

Results

The literature search yielded 860 papers of all levels of evidence, with the most represented level being 2++ (Figure 3). The answers to the 33 questions, the alerts and the bundles, are herein provided, grouped by the five main domains.

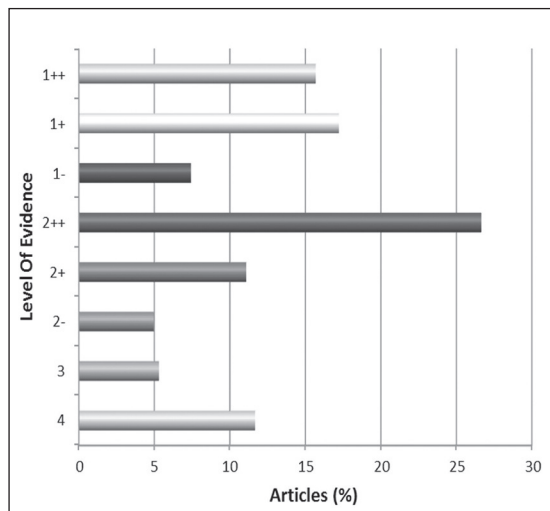


Figure 3.—Levels of evidence of the 860 selected articles.

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### A. The challenge of obesity in the hospital

#### Question A1. Do obese patients present specific perioperative and periprocedural risks?

**Answer:** In obese patients, maintaining a balance between risks and benefits is a challenge throughout the perioperative period, for surgery and other invasive procedures.<sup>3</sup> Anesthesiologists, as members of a multidisciplinary team, play a key role in risk management, not only for surgical pathways.<sup>2,6</sup>

**Alert:** Many medical institutions and societies have already published practice guidelines and position statements on how to improve the care of obese patients. Local facilities have to be tailored to these CPWs so that they become established national standards.

#### Bundle A1.

- Obese patients must be informed about the best clinical practices for every treatment (not only surgical procedures) that requires sedation, anesthesia or analgesia. These clinical practices regard airway management and respiratory support in elective and emergency situations.
- The information provided must focus on the risks of these clinical practices and on the existence of potentially safer alternatives.
- Written informed consent must be provided by the patient and by the anesthesiologist, as well as by other health care professionals involved (shared decision making).

The CPWs should be under the leadership of a specialist in anesthesiology and intensive care.

**Rating:** Feasibility: 4; Importance: 5.

#### Question A2. How should airway and respiratory risk assessment be tailored to obese patients? Are special facilities needed?

**Answer:** A patient with a predominantly peripheral fat distribution is described as being “pear-shaped”, while one with central/vis-

ceral obesity is described as “apple-shaped”; an apple shape is associated with a greater risk of difficult ventilation. The key point for risk assessment in these patients is determining if they have metabolic syndrome or other comorbidities, such as OSA. BMI alone is a poor indicator of difficult intubation.<sup>7</sup> A recent study suggested that BMI > 50 kg/m<sup>2</sup> is an independent predictor of difficult mask ventilation before laryngoscopy.<sup>8</sup> Although it is useful to screen patients for OSA using polysomnography,<sup>9</sup> there is insufficient evidence to support the cancelling or delaying of surgery until this diagnosis is made unless the patient has uncontrolled systemic disease or additional problems of ventilation or gas exchange. Use of the STOP-BANG questionnaire may help predict difficult airway management.

**Alert:** The risk evaluation should consider the experience of the staff, the hospital organization, and the availability of special facilities and equipment such as polysomnography, open head MRI, a post-anesthesia care unit (PACU), and an intensive care unit (ICU). Patients who have a high probability of OSA may proceed to surgery in the same manner as those with a confirmed diagnosis, provided that strategies for mitigation of postoperative complications are implemented.

**Bundle A2.** In addition to standard scoring of difficult airways,<sup>10</sup> the evaluation of risks in obesity must include several other clinical variables that are easily obtained at the bedside:

- presence or absence of metabolic syndrome;
- neck circumference (critical threshold, >41 cm/16” for women; >43 cm/17” for men);
- aspiration risk (presence of gastroesophageal reflux disease; GERD);
- waist-to-hip ratio (critical threshold for central obesity, >0.8 for women; >0.9 for men);
- BMI higher than 50 kg/m<sup>2</sup>;
- STOP-BANG score (critical threshold ≥5).

This information must be reported in the anesthesiological and clinical documentation. A locally shared protocol must identify roles and responsibilities in decision-making.

**Rating:** Feasibility: 3; Importance: 5.

**Question A3. What is the required volume of activity to ensure the safety of airway management and respiratory care in obese patients?**

**Answer:** A minimum threshold of volume for optimal clinical outcomes has not been clearly identified.<sup>11</sup> However, BMI, surgical complexity and the American Society of Anesthesiologists (ASA) Physical Status classification system should be discussed within the team, especially if local facilities do not guarantee the needs for optimal care.<sup>12</sup> Appropriate management of such critical patients requires a team experienced in obesity care, including specialists such as cardiologists and pneumologists, as well as nurses, physiotherapists and whatever else is needed to guarantee a progressive increment to high-dependency units, or a step-down to an intermediate care unit or ward.<sup>3</sup>

**Alert:** *It is strongly suggested to define the minimum standard of care for elective and emergency procedures in every hospital.*

**Bundle A3.** To manage obese critical patients at risk of predictable complications:

- experienced staff, good hospital organization and appropriate facilities must be available, especially for elective procedures;
- an adequate number of physicians and nurses is required around the clock, 24 hours a day;
- concerns should be reported in the clinical documentation following a multidisciplinary agreement;
- all issues related to safety or insufficient facilities must be discussed with the patient, who must give written informed consent to proceed.

**Rating:** Feasibility: 2; Importance: 5.

**Question A4. Is an ERAS approach feasible?**

**Answer:** Implementation of a complete program of ERAS may not be always feasible. However, even one items of such a program can be useful if adopted during the hospitalization of obese patients.<sup>13, 14</sup>

**Alert:** *A proactive, multimodal approach is fundamental and must consider individual skills and both technological and methodological resources.*

**Bundle A4.** The following items are suggested:

- preoperative information, education and counseling;
- early evaluation for risk assessment;
- preoperative optimization (e.g., smoking cessation, alcohol avoidance, weight loss, diabetes control);
- prevention of postoperative nausea and vomiting;
- preference for mini-invasive surgical techniques;
- prolonged preoxygenation in ramped position and positive pressure ventilation;
- neuromuscular block and anesthetic depth monitoring;
- multimodal pain management;
- multimodal and prolonged thromboprophylaxis;
- monitoring diuresis to detect early rhabdomyolysis;
- early postoperative nutrition;
- early mobilization;
- postoperative monitoring and early treatment of oxygenation disorders, using non-invasive positive pressure ventilation (NPPV) or non-invasive continuous positive airway pressure (nCPAP) in patients with BMI > 50 kg/m<sup>2</sup>, severe OSA and severe obesity hypoventilation syndrome.

**Rating:** Feasibility: 2; Importance: 3 (5 for the alert).

### B. Preoperative assessment

#### Question B1. What are the requirements for identifying OSA in obese patients?

**Answer:** Obese patients often have undiagnosed OSA. This condition puts these patients at increased risk of postoperative oxygen desaturation, respiratory failure, cardiac events and unplanned ICU admission.<sup>9, 15</sup> Sedation and opioids may worsen upper airway collapsibility and impair arousal response, thereby aggravating OSA symptoms.<sup>3, 15, 16</sup>

**Alert:** *In the presence of OSA risk factors, a safety strategy for induction of anesthesia must be ready. Physicians must be aware of undesirable sedation in the postoperative phase and whenever a sedative or analgesic drug is administered.*

**Bundle B1.** Screening and prevention of OSA adverse events in obese patients follows the best practices listed below.

- Polysomnography is the gold-standard diagnostic method and should be used, when available, without delaying the clinical evaluation process.
- The STOP-BANG questionnaire, which has high sensitivity but low specificity, must be administered to obese patients.
- Perioperative nCPAP in compliant patients reduces the risk of pulmonary complications.
- It is mandatory to provide induction and waking-up of obese OSA patients in a monitored area such as operating room (OR) or PACU; adequate time and resources must be devoted to these procedures.
- The administration of opioids or sedatives requires special care.

**Rating:** Feasibility: 3; Importance: 5.

#### Question B2. Do obese surgical patients require particular cardiorespiratory evaluations?

**Answer:** Cardiac failure and respiratory failure are prevalent in the obese population, adding risk factors for intra- and postoperative complications.<sup>16</sup> Fast screening assessment can determine if other more specialist tests or instrumental investigations are needed to preoperatively identify and treat high-risk patients.<sup>17, 18</sup>

**Alert:** *A proactive safety strategy in respiratory care requires that surgical patients should be screened for central obesity and metabolic syndrome.*

**Bundle B2.** Obese patients must undergo a cardiology (including echocardiography) or pulmonary assessment, or both when they have a:

- STOP-BANG score  $\geq 5$ ;
- metabolic equivalent of task  $\leq 4$ ;
- peripheral oxygen saturation (SpO<sub>2</sub>)  $< 94\%$  (in supine position in ambient air);
- diagnosis of OSA;
- unable to tolerate nCPAP at home.

The decision based on this overall assessment is crucial in establishing patient safety pathways and, for the team, handover procedures and specific alerts.

**Rating:** Feasibility: 2; Importance: 5.

#### Question B3. How should patients with metabolic syndrome and central obesity be managed?

**Answer:** Metabolic syndrome is defined by the presence of at least three of the following conditions: diabetes, dyslipidemia, visceral obesity, and hypertension.<sup>19</sup> Metabolic syndrome, together with smoking, is one of the main causes of preventable perioperative adverse events and mortality.<sup>3, 20</sup>

**Alert:** *Metabolic syndrome and central obesity must be recognized as specific risk factors for perioperative or periprocedural complications, including those following difficult airway management.*



**Bundle B3.**

- Metabolic syndrome is a warning that airway management may be difficult.
- Lifestyle interventions for weight loss and smoking cessation (ideally 4-8 weeks before surgery) should be implemented.
- Strict blood glucose control is important even in the absence of a diagnosis of diabetes.

**Rating:** Feasibility: 4; Importance: 5.

**Question B4. Which level of postoperative care should be planned for obese patients? Is it mandatory to have recovery room, PACU or level III care facility?**

**Answer:** Open surgery, reoperation, diabetes mellitus, chronic respiratory disease and OSA are the strongest predictors of unplanned ICU admission.<sup>21, 22</sup> The need for a higher intensity (Level II or III) of care depends more, however, on comorbidities and on the complexity and duration of the surgery than on BMI per se. The preoperative assessment is fundamental for risk quantification and stratification.<sup>23</sup> The Obesity Surgery Mortality Risk Score (OS-MRS) has been designed to predict mortality after gastric bypass in bariatric surgery; although not yet validated for use in non-bariatric surgery, this tool may one day have broader use for obese surgical patients.<sup>3, 24</sup>

**Alert:** *Proactive handover strategies, such as having available beds for high levels of care, can help avoid last-minute OR case deletion. An OS-MRS of 4 or 5 suggests the need for closer postoperative monitoring.*

**Bundle B4.** Perioperative optimization must be carefully planned, with provisions for:

- Level III care, if the multidisciplinary evaluation reveals comorbidities or if high-risk surgery is scheduled;
- Special instrumentation, routinely checked in the OR and in other care settings such as emergency department (ED) and delivery rooms;

- Checklists of the required devices and equipment for the whole multidisciplinary team (strongly suggested).

**Rating:** Feasibility: 4; Importance: 5.

**Question B5. How can team communication be improved for the safest care of obese patients?**

**Answer:** Key notes and alerts at each step of the CPW must provide appropriate strategies to prevent avoidable complications.<sup>23, 25</sup>

**Alert:** *Proactive measures and handover plans must include: patient information, shared and written team communications, an OR safety checklist with sign-in and sign-out alerts, check for RR or PACU availability, “can’t intubate can’t oxygenate” (CICO) strategies, safe extubation procedures, alerts and plans for the rapid response system (RRS), and ICU team involvement.*

**Bundle B5.** Operating lists must include information on each patient’s weight and BMI. When patients with BMI  $\geq 30$  kg/m<sup>2</sup> are scheduled, the team must include experienced anesthesiologists and surgeons responsible for the CPWs. A competency-based continuing medical education program should aim to raise the knowledge, skills and attitudes of the health workers.

- Patient dignity is important, so suitably sized OR gowns and disposable underwear should be available.
- The postoperative care staff must be adequate in terms of number of nurses and physiotherapists, according to the kind of surgery and the patient’s clinical conditions.
- A safe area for recovery must be available for an adequate period of time.

**Rating:** Feasibility: 4; Importance: 5.

**Question B6. Are there particular issues when planning day surgery or ambulatory surgery for obese patients?**

**Answer:** There is currently limited evidence to guide the selection of obese patients

who can safely undergo day or ambulatory surgery.<sup>26, 27</sup> However, a BMI >50 kg/m<sup>2</sup> should discourage these approaches because of the greater risk of perioperative complications. An expert team must always be available for airway management, perioperative pain control with multimodal analgesia, control of postoperative nausea and vomiting, and tailored monitoring.<sup>28</sup>

**Alert:** *Strict adherence to eligibility criteria for day and ambulatory surgery is fundamental for obese patients.*

**Bundle B6.** In addition to BMI >50 kg/m<sup>2</sup>, other factors that may render a patient ineligible for day or ambulatory surgery are:

- uncontrolled comorbidities;
- non-adherence to nCPAP by patients with OSA;
- invasiveness and complexity of the surgical procedure;
- need for general anesthesia or deep sedation;
- need for opioids.

**Rating:** Feasibility: 5; Importance: 5.

### Question B7. What are the limits using of non-operating room anesthesia in obese patients?

**Answer:** In patients receiving non-operating room anesthesia (NORA), suboptimal monitoring facilities or the inability to prevent and manage oversedation may lead to severe complications due to inadequate oxygenation.<sup>29</sup> Indeed, there has been an increase in the number of injury and liability claims regarding monitored anesthesia care (MAC). Chronic hypoxemia or hypercapnia may worsen acute hypoventilation in the early postoperative period following the administration of anesthetics and opioids.<sup>28</sup> NORA requires appropriate clinical management, supported by dedicated devices and systems for monitoring the depth of anesthesia.<sup>3, 30, 31</sup>

**Alert:** *Procedural sedation and analgesia (PSA)-related complications are frequent in*

*obese patients with severe comorbidities, OSA or predicted difficult airways. The selection of anesthetics should take into consideration both pharmacokinetic and pharmacodynamic properties. Skilled and experienced management is recommended. Capnography in patients under NORA is essential for early apnea detection.*

**Bundle B7.** A specific CPW must be planned for obese patients under NORA.

- The administration of NORA should be at the same standard of OR anesthesia.
- Monitoring by experienced anesthetists, use of appropriate devices, and management by dedicated staff in accordance with predefined protocols and checklists should enhance safety.

**Rating:** Feasibility: 5; Importance: 5.

### C. Intraoperative care

### Question C1. Does positioning obese patients require special care during airway management?

**Answer:** Obese patients have a shorter safe apnea time, altered lung mechanics, and increased risk of gastroesophageal reflux disease (GERD). Laryngoscopic view can be also more difficult.<sup>32-34</sup>

**Alert:** *Suitable techniques for minimizing risks and length of time of hypoventilation during induction, intubation and recovery must be adopted.*

**Bundle C1.** Positioning is crucial in obese patients.

- The ramped position, also called head-elevated laryngoscopy position (HELP), or the sitting position must be used during preoxygenation, intubation and extubation procedures.

**Rating:** Feasibility: 5; Importance: 5.

### Question C2. “Airway management in obese patients is difficult”: myth or truth?

**Answer:** In obese patients, mask ventilation is difficult and laryngoscopy can be challenging.<sup>3, 10, 35-37</sup>

**Alert:** *It is strongly recommended to adopt a robust airway management strategy.*

**Bundle C2.** A plan for airway safety must always be ready and discussed before every procedure, including PSA as well as locoregional ones, considering:

- ramped position;
- high-flow nasal cannula oxygen therapy, nCPAP, or NPPV;
- deep induction and curarization;
- awake videolaryngoscopy can be a potential alternative to awake fiberoptic intubation (AFOI);
- beard shaving or trimming.

**Rating:** Feasibility: 5; Importance: 5.

### Question C3. Are supraglottic airway devices useful during anesthesia?

**Answer:** Second-generation supraglottic airway devices (SADs) are well supported by EBM in obese patients for both airway rescue and elective procedures.<sup>3, 35-38</sup>

**Alert:** *SADs must be available for airway rescue, considering the advantage of fiberoptic intubation (FOI) through an oral conduit.*

**Bundle C3.** The anesthesiologist in charge of obese patients must be skilled in the use of second-generation SADs, evaluating issues such as:

- increased risk of aspiration;
- lack of sizing rules, although the patient's ideal body weight (IBW) can help;
- better performance for minor procedures.

**Rating:** Feasibility: 4; Importance: 5.

### Question C4. What are the roles and limits of AFOI?

**Answer:** In obese patients, benefits from AFOI include a reduced risk of desaturation

and difficult ventilation.<sup>39</sup> If concurrent sedation is needed, adequate dosing and positive pressure ventilation by mask are crucial.<sup>40</sup> Videolaryngoscopy, emerging as an alternative to AFOI, is not yet standardized.<sup>41, 42</sup>

**Alert:** *Bedside evaluation of obesity-related risk factors for difficult mask or SAD ventilation is mandatory. The prediction of difficult ventilation should trigger AFOI.*

**Bundle C4.** The anesthesiologist in charge of obese patients must be skilled in managing sedation, AFOI, as well as combined techniques. Video-guided technology and experience are mandatory. Other issues to consider are:

- patient's cooperation;
- advantages of AFOI technique;
- patient's response to sedation;
- training including simulation (strongly suggested for the whole team).

**Rating:** Feasibility: 5; Importance: 5.

### Question C5. What are the roles and limits of videolaryngoscopy and CICO management?

**Answer:** Videolaryngoscopy improves the laryngoscopic view and may reduce the need for FOI in selected patients.<sup>41-44</sup> Awake videolaryngoscopy, which requires fewer skills than AFOI, may also be considered.

**Alert:** *Videolaryngoscopy is a powerful technique for airway management, provided that operators have adequate training and knowledge of its limitations and risks of failure. Nevertheless, airway assessment is recommended and all aspects should be evaluated, including front-of-neck access.*

**Bundle C5.** Videolaryngoscopes should be available whenever airway management is predicted to be difficult. Anesthesiologists should be trained in technical and non-technical skills.

- Awake videolaryngoscope intubation may be considered (less challenging than AFOI, but not always successful).

- Intubation time may be longer.
- Rescue plans and crisis resource management (CRM) training are mandatory.

**Rating:** Feasibility: 3; Importance: 4.

### Question C6. What is the required level of OR monitoring?

**Answer:** Anesthesia of obese patients is linked to a high number of adverse events in OR and in postoperative care.<sup>45, 46</sup> Awareness risk is increased in obese patients.<sup>47</sup>

**Alert:** *Perioperative or periprocedural monitoring is mandatory in obese patients.*

**Bundle C6.** To reduce adverse events in the OR, PACU and ICU, monitoring must focus on:

- SpO<sub>2</sub> (crucial for patients with OSA; useful as a discharge decision variable);
- EtCO<sub>2</sub>, also during NORA, MAC and early postoperative phase;
- neuromuscular block (mandatory for withdrawal and OR discharge);
- hemodynamics, tailored to the risks;
- depth of anesthesia (optional).

**Rating:** Feasibility: 4; Importance: 5.

### Question C7. What is the risk of GERD?

**Answer:** High BMI is associated with an increased risk of GERD and its complications.<sup>3, 48-51</sup>

**Alert:** *Obesity predisposes to GERD, increasing the risk of pulmonary aspiration. Patients who have undergone bariatric surgery in the past are at particular risk because of their gastric dysfunction.*

**Bundle C7.** Consider using:

- antacid or antireflux drug;
- ramped position during facemask ventilation;
- gentle mask ventilation to prevent gastric insufflation.

**Rating:** Feasibility: 5; Importance: 5.

### Question C8. When and how should locoregional anesthesia be used?

**Answer:** Locoregional techniques should be preferred to general anesthesia, despite the fact that they are more challenging; the availability of appropriate devices and skills can be decisive.<sup>52, 53</sup> The risk of oxygen desaturation must always be considered.<sup>54, 55</sup>

**Alert:** *Airway risk assessment must be done and a rescue plan must be ready in case of failure of locoregional anesthesia.*

**Bundle C8.** Patients must be informed about the risk of locoregional failure and the availability of rescue techniques. Moreover:

- the dose of local anesthetic has to be calculated according to IBW;
- performing the block with the patient in sitting position reduces the incidence of failure;
- locoregional anesthesia devices must be of suitable length. The depth of insertion of an epidural catheter must be checked (at least 5 cm);
- ultrasonography is advisable despite anatomical difficulties.

**Rating:** Feasibility: 4; Importance: 4.

### Question C9. How can general anesthesia safety for obese patients be improved?

**Answer:** The volume of distribution in obese patients is variable and drug-dependent.<sup>56</sup> Lean body weight (LBW) and adjusted body weight (ABW) should be used as references for hydrophilic drugs and lipophilic drugs, respectively. Hydrophilic NMBAs distribute mainly in the central compartment and should be dosed on LBW. The levels of safety of general anesthesia with inhalation or target-controlled infusion (TCI) are equivalent. Recovery from anesthesia seems to be faster with desflurane.<sup>57</sup> Remifentanyl is a safe, effective and short-acting analgesic that allows a rapid recovery of lung function. Dexmedetomidine may be a useful option because it does not influence the breathing pattern and reduces the need for opioids; however, in Italy, this drug is

not approved for use in anesthesia. Treatment with clonidine and S-ketamine does not compromise the respiratory drive and provides analgesia with an opioid-sparing effect. There is little evidence to support the use of pregabalin as an adjunct part of multimodal analgesia.

**Alert:** *It is important to monitor for possible awareness during anesthesia. TCI systems cannot be used for patients who weigh more than 140-150 kg.*

**Bundle C9.** The depth of anesthesia should always be considered in obese patients, especially during total intravenous anesthesia with NMBAs. It is mandatory to provide:

- short-acting drugs;
- a tailored strategy for dosing NMBAs;
- multimodal analgesia with a local or locoregional technique;
- monitoring, positioning and level of care adequate for any procedure in analgesation.

**Rating:** Feasibility: 5; Importance: 5.

#### Question C10. Is RSI recommended?

**Answer:** Despite the higher risk of GERD in obese patients,<sup>33, 58, 59</sup> there is no consensus on the routine use of RSI.<sup>3</sup>

**Alert:** *The obese patient does not always require RSI.*

**Bundle C10.** Indications for RSI in obese patients are:

- full stomach;
- pregnancy;
- symptomatic GERD.

**Rating:** Feasibility: 5; Importance: 5.

#### Question C11. How can postoperative pulmonary complications in obese patients be prevented?

**Answer:** Perioperative noninvasive respiratory support reduces postoperative morbidity and improves perioperative care and outcomes in obese patients.<sup>15, 60, 61</sup> Volume-controlled ventilation, with high positive end-expiratory pres-

sure (PEEP) and single recruitment maneuvers, improves pulmonary compliance.<sup>62, 63</sup> In non-obese patients, intraoperative protective ventilation (tidal volume, 6-8 mL/kg of IBW) reduced the incidence of intraoperative atelectasis.<sup>63</sup>

**Alert:** *Improving the oxygen reserve is mandatory in treating or stabilizing preoperative patients with OSA or cardiopulmonary comorbidities. Appropriate levels of PEEP and recruitment maneuvers can prevent atelectasis and may help maintain the lungs fully aerated.*

#### Bundle C11.

- Preoxygenation is mandatory and intraoperative protective ventilation is advisable.
- Postoperative nCPAP or NPPV can be considered in selected patients. There is no evidence that these procedures interfere with the surgical anastomosis.

**Rating:** Feasibility: 5; Importance: 5.

#### Question C12. How can laparoscopy be safely performed in obese patients?

**Answer:** Laparoscopy in obese patients can be challenging.<sup>64</sup> Visceral obesity is a predictor of outcomes.<sup>65</sup>

**Alert:** *In the 9 weeks prior to elective surgery, an attempt should be made to reduce BMI by 10% or to <55 kg/m<sup>2</sup>. During surgery, all OR team members must pay attention to the patient's position.*

#### Bundle C12. During laparoscopy:

- continuous invasive blood pressure monitoring should be recommended;
- the cranial dislocation of adipose tissue, the protection of pressure points, and the thromboembolic prophylaxis must be checked by the whole team;
- the risk of tracheal tube dislocation during pneumoperitoneum is high;
- deep neuromuscular blockade is recommended to optimize the laparoscopic workspace, with lower pneumoperitoneum pressure.

**Rating:** Feasibility: 5; Importance: 5

### Question C13. How should cesarean section in obese women be managed?

**Answer:** The anesthesiologist is under considerable pressure to guarantee maternal-neonatal safety, since obese parturients often have comorbidities that increase the risk of desaturation, aspiration, and deep vein thrombosis/pulmonary embolism (DVT/PE).<sup>66, 67</sup> Locoregional anesthesia may fail.<sup>5, 68</sup> Particular attention should be paid to airway management, considering that the risks during delivery analgesia and cesarean anesthesia are magnified by obesity.<sup>69</sup>

**Alert:** A dedicated, skilled team should always be available. They should be informed of the BMI of pregnant patients, especially when operative delivery is required.

**Bundle C13.** A decision-making strategy must consider early warnings. A multidisciplinary CPW is mandatory for obese pregnant women.

- Primary care services and obstetricians should advise all women of childbearing age to regularly monitor their body weight.
- BMI and waist circumference data must be considered in the assessment of risk, both in natural delivery and cesarean delivery.
- These patients must undergo anesthesiological evaluation early in the pregnancy.
- Obese pregnant women must receive information and advice about the risks of difficult airway management, independently of the expected type of delivery or anesthesia.
- Early placement of an epidural catheter can avoid the associated risks of general anesthesia when operative delivery is required.
- Pulmonary aspiration prophylaxis must be considered.
- Videolaryngoscopy and second-generation SADs must be immediately available.
- A dedicated, skilled team is mandatory.

**Rating:** Feasibility: 5; Importance: 5.

### D. Postoperative safety

### Question D1. How should NMBAs in obese patient be managed?

**Answer:** The incidence of postoperative residual curarization is higher in obese than non-obese patients.<sup>70</sup> Predicting difficult airway management and safe planning are the cornerstone of good clinical care,<sup>32</sup> because sugammadex alone may not be the solution.

**Alert:** RSI with rocuronium and sugammadex is still under discussion. A CICO scenario may not be reverted even with prompt and adequate sugammadex administration.

#### Bundle D1.

- Monitoring is mandatory to determine the appropriate dosage of NMBAs.
- A train-of-four ratio  $\geq 0.9$  is mandatory before awakening patients from anesthesia and discharging them from the OR, RR or PACU.
- The doses of neostigmine and sugammadex should be calculated from ABW and total body weight (TBW), respectively.
- A robust airway management plan is mandatory.

**Rating:** Feasibility: 5; Importance: 5.

### Question D2. Which are safe extubation strategies for obese patients?

**Answer:** NAP4<sup>50, 51</sup> and NAP5<sup>47</sup> highlighted the critical points of extubation and obesity risks.<sup>70</sup>

**Alert:** The extubation phase must be in accordance with current GCPs; specific devices are helpful.

#### Bundle D2.

- A safe extubation strategy includes neuromuscular blockade monitoring and reversal.
- Attention is mandatory in case of suspected or diagnosed OSA.
- The sitting position (25-30°) is strongly suggested during recovery from anesthesia.

**Rating:** Feasibility: 5; Importance: 5.

**Question D3. Where and how should post-operative care be performed?**

**Answer:** Clinical expertise<sup>24</sup> and judgment<sup>22</sup> are required in all circumstances<sup>12, 25</sup> to ensure the best care in the most appropriate facility: general ward, RR, PACU or ICU.<sup>21, 71-73</sup>

**Alert:** *Track-and-trigger tools can be safely used to determine the required intensity of assistance; they can suggest the need to up- or downgrade the level of care, thus reducing inappropriate ICU recovery.*

**Bundle D3.**

- The decision-making process for tailoring the level of care must be multidisciplinary and involve all team members.
- Structural issues can be critical, and local factors must be considered to organize the safest care system (e.g., RRS). A standardized national early warning score (NEWS) should be implemented.<sup>74</sup>

**Rating:** Feasibility: 3; Importance: 5.

**Question D4. How can DVT/PE be prevented?**

**Answer:** Obesity induces an inflammatory state, and BMI is a risk factor for DVT/PE.<sup>75, 76</sup> Major abdominal and oncological surgery and open surgery in patients with a BMI > 55 kg/m<sup>2</sup> are also risk factors for DVT/PE. New oral anticoagulants (e.g., dabigatran) and fondaparinux are as effective as low molecular weight heparin.<sup>76</sup>

**Alert:** *Prophylaxis against DVT/PE is mandatory. The use of anticoagulants, however, does not preclude mechanical strategies and early postoperative mobilization.*

**Bundle D4.**

- Prophylaxis against DVT/PE is based on pharmacological and mechanical strategies.
- The dose of low molecular weight heparin should be adjusted to the body weight.
- A vena cava filter is not recommended for primary prophylaxis.

- Early mobilization and active mechanical pressure on the legs are effective prophylaxis.

**Rating:** Feasibility: 4; Importance: 5.

**Question D5. How can rhabdomyolysis be avoided?**

**Answer:** During prolonged interventions, muscle pressure injuries may develop.<sup>16, 77, 78</sup> This complication is more frequent in men with a BMI > 50 kg/m<sup>2</sup> who also have diabetes and peripheral vascular disease. Rhabdomyolysis can be detected immediately after surgery.<sup>3</sup> If unrecognized or untreated, it may lead to severe electrolyte disturbances, cardiac dysrhythmia, and cardiac arrest. Late complications include renal failure and disseminated intravascular coagulation.

**Alert:** *Rhabdomyolysis is diagnosed by a five-fold elevation in serum creatine phosphokinase (e.g., >1000 IU/L). Renal failure occurs only when creatine phosphokinase exceeds 5000 IU/L.*

**Bundle D5.** Rhabdomyolysis and its complications in high-risk obese patients can be prevented by:

- reducing the duration of surgery;
- avoiding intraoperative hypovolemia;
- making an early diagnosis;
- treating with large amounts of intravenous fluids.

**Rating:** Feasibility: 5; Importance: 5.

*E. Alerts and warnings for special settings***Question E1. How should obese patients be treated for pain in the general ward?**

**Answer:** Proper planning and management of acute pain should take into account the patient's characteristics and the expected pain intensity and duration in the postoperative period.<sup>3, 79</sup> Sleep-disordered breathing significantly increases the risk of adverse cardiovascular and respiratory complications.<sup>54, 55</sup>

**Alert:** Caution is required when prescribing long-acting opioids and sedatives. Oxygen therapy should be continued in the ward until baseline SpO<sub>2</sub> is achieved (considering postoperative nCPAP or NPPV in previously treated OSA patients). Use of NEWS facilitates risk assessment and helps to modulate the post-procedural level of care and to track the clinical outcome. In patients not compliant with preoperative nCPAP therapy but requiring long-acting opioids by both intravenous and neuroaxial administration, the level of care must be upgraded.

**Bundle E1.** Pain treatment of obese patients in the general ward involves:

- head-up position;
- evaluation of pain and recording using a score, at rest and during movement;
- avoidance, whenever possible, of the intramuscular route for drug administration;
- careful titration of opioids, preferring patient-controlled analgesia over continuous intravenous administration;
- multimodal strategies, short-acting drugs and loco-regional techniques, to reduce opioid requirements and decrease sedation, promoting early mobilization and ambulation;
- early mobilization and physiotherapy;
- a 24-hour postoperative evaluation by an acute pain service led by anesthesiologists, in a multidisciplinary approach tailoring protocols to the obese patient.

**Rating:** Feasibility: 4; Importance: 5.

**Question E2.** How should the ED prepare to deal with obesity?

**Answer:** Obese patients are more likely to present to the ED as they are more prone to disease and cardiorespiratory emergencies. Critical issues include size-related logistics and limitations of physical assessment. Monitoring and routine investigations can be challenging; invasive procedures, included endotracheal intubation, can be particularly difficult.<sup>51, 80, 81</sup>

**Alert:** The suitability of ED equipment must be checked, and capnography must be available. The first-line staff may not be experienced with obese patients. Specialists in anesthesia and intensive care, being skilled in airway management, must be alerted.

**Bundle E2.** The ED is a high-risk setting that presents challenges in airway management: a dedicated team, based on the concept of the right person, right place, right equipment and right preparation, is required. Checklists and preplanned strategies can increase the safety of obese patients, regarding:

- staffing, equipment, and spaces for procedures and moving supplies;
- patient handling and transferring;
- educational initiatives for the team, focusing on technical skills and non-technical team strategies.

**Rating:** Feasibility: 5; Importance: 5.

**Question E3.** How should RRS prepare for in-hospital emergencies involving obese patients?

**Answer:** Anesthesiologists and intensive care teams are often involved in in-hospital emergencies. The particular needs of obese patients can stress RRS (e.g., medical emergency team, MET).<sup>74, 82</sup>

**Alert:** Cardiopulmonary resuscitation can be difficult in obese patients because the rescuer's position may be suboptimal.<sup>83</sup> Adequate technical equipment and practical skills of all team members significantly help reduce risks and increase the chances of success in rescuing obese patients. Communication among team members and scoring on a color-coded clinical chart must be optimal. A track-and-trigger system can identify the required level of care.

**Bundle E3.**

- Use of NEWS can help detect clinical deterioration, alert the MET, and initiate a timely, competent clinical response.



- The workload of nurses must be adjusted to the requested level of care.
- Basic rescue equipment must be standardized in the ward.
- Equipment for airway management must include devices for failed intubation (second-generation SADs) and CICO scenario, considering the increased aspiration risk.
- A step or platform may help perform chest compressions. Defibrillation energies do not need to be modified for patients with high BMI.
- Transfer equipment and beds must be appropriate, with generous size and weight limits.
- Hospitals may make agreements with veterinary services that have large CT scanners, even if this means exposing patients to the risks of off-site transfer.
- Inter-hospital transfer by road or air requires the availability of large ambulances: specialists and additional personnel must be available.

**Rating:** Feasibility: 2-3; Importance: 5.

*Question E4. How should ICU teams prepare for obese patients?*

**Answer:** Specific changes are required to adapt the standards of ICU care to the increasing obese population. Considering the many reasons for admitting obese patients to an ICU (e.g., scheduled or unplanned postoperative care, critical primary illnesses, complications due to comorbidities, trauma), the clinical challenges are not merely due to the high BMI.<sup>84</sup> The incidence of difficult intubation of obese patients in the ICU<sup>51, 85, 86</sup> is twice that in the OR, and life-threatening complications related to intubation are 20-times more frequent.<sup>87</sup> However, obesity is thought to be protective during critical illnesses. This so-called obesity paradox presents as a lower risk of ICU death in obese than normal-weight patients, although the length of stay of an obese person in the ICU can be longer. A bet-

ter understanding of the association between metabolic status and inflammation may help in developing appropriate screening and therapeutic strategies.

**Alert:** *Critically ill obese patients require a multidisciplinary approach able to deal with the higher incidence of difficult airway and respiratory related complications. Caring for obese patients includes the need for adequate nursing and specific rehabilitation goals to minimize secondary damage and impairment.*

#### **Bundle E4.**

- Team competencies in airway management, adequate equipment for advanced skills and non-technical team strategies are mandatory to manage obese patients in the ICU and should focus on rehabilitation strategies.
- The safe transfer of obese critically ill patients needs special care and attention to logistics to accommodate large persons (e.g., large lifts, stretchers).
- A team strategy must be defined to respond to the expected clinical scenario in critical care (e.g., limited mouth opening, severe hypoxemia, difficult ventilation, coma, accidental extubation, tracheostomy decannulation).
- Use a risk score regarding factors related to the patient, pathology and operator (e.g., MACOCHA score, Figure 4) can help in obese airway CRM.
- The management of crises can be guided by checklists and bundles. Protocols for endotracheal intubation and RSI have been proposed for these patients (Figure 5).
- A challenge-response, regular practice of skills, and airway team trained by simulation can improve the CRM.
- Special attention must be given to “front-of-neck access” feasibility and risks (for election or emergency).
- Protective ventilation must always be applied.
- Ultrasound-assisted vascular access is mandatory.

- Hemodynamic monitoring in obese patients is no different from that in normal-weight patients, but requires indexing according to the body surface area or LBW.
- Dosing intravenous drugs is critical and should be based on LBW, TBW or IBW.
- Sedatives can be considered under several therapeutic categories or situations, but sedation in obese patients should follow the same broad principles currently used in ICU practice, e.g., maintaining the patient calm, awake and cooperative, and using multimodal sedation. The current variety of sedatives (e.g., alpha-2 agonists and S-ketamine) provides anesthesiologists with many options.
- A multimodal approach to venous thromboembolism prophylaxis is recommended.
- Obesity does not protect against adverse nutritional states. Adequate nutrition attenuates oxidative stress and modulates the systemic immune response. The enteral route is to be preferred.
- Respiratory rehabilitation and physiotherapy should be undertaken as soon as possible, and should include bronchial drainage and progressive weaning from mechanical ventilation.
- Regarding the prevention of pressure sores, more staff is needed to move obese patients.
- Basic equipment for obese patients includes large beds with strong side railings, large pressure-relieving mattresses, hoists, kinetic beds, and large chairs.
- The patient and his or her family should be provided with appropriate information regarding medical and psychosocial issues.

**Rating:** Feasibility: 5; Importance: 5.

*Future perspectives*

Despite a large amount of new data in the peer-reviewed literature regarding the care

Factor	Points
Factors related to patient	
- Mallampati score III or IV	5
- Obstructive sleep apnea syndrome	2
- Reduced mobility of cervical spine	1
- Limited mouth opening <3 cm	1
Factors related to pathology	
- Coma	1
- Severe hypoxemia (80%)	1
Factor related to operator	
Nonanesthesiologist	1
Total 12	
<b>Coded from 0 to 12: 0 = easy; 12 = very difficult</b>	

Figure 4.—Calculation of the MACOCHA score (modified from De Jong *et al.*<sup>85</sup>).

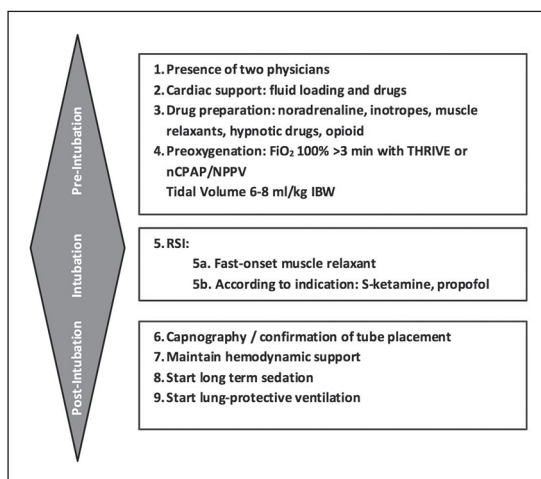


Figure 5.—Protocol for endotracheal intubation in the critically-ill patient (modified from Jaber *et al.*<sup>86</sup>).  
 IBW: ideal body weight; nCPAP: non-invasive continuous positive airway pressure; NPPV: noninvasive positive-pressure ventilation; RSI: rapid sequence induction; THRIVE: transnasal humidified rapid-insufflation ventilatory exchange.

of the increasing obese population, national health care systems are inhomogeneous in the regional distribution of specialist centers and bariatric surgery units. Surgical outcomes are strictly dependent on teamwork involving different health care professionals. The SIAARTI Task Force hopes that these consensus bundles will stimulate every specialism of the health care system interested in the field to promote national and regional campaigns, thus improving the safety of obese patients.

The main unsolved issues are:

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1. the definition of the level of specialist knowledge and experience that the team should have;

2. the identification of the learning curves for relevant techniques (e.g., airway management);

3. the standardization of the use of high-fidelity simulation as a learning strategy;

4. the definition of the numbers of professional staff (including nurses) needed to care for these challenging patients, even in hospitals not performing bariatric surgery;

5. the definition of the volume of clinical activity in hospitals necessary for optimal health care outcomes and safety of obese patients and for the containment of hospital costs;

6. the demonstration of the role of standardization in positively influencing patient outcomes;

7. the establishment of best practices in the prehospitalization workup of obese patients, especially before elective procedures.

8. Standardization promotes high-quality patient care in a cost-effective manner. By creating this consensus of bundles and alerts and by promoting further research in this direction, SIAARTI and the other societies involved aim to support health care systems in improving the level of care of obese patients. The implementation of CPWs including these GCPs for obese adult patients will depend on future initiatives supported by the involved societies. Regional and national health care officers and hospital administrators must also be sensitized to the issues covered by this consensus.

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For supplementary materials, see the online version of this article.

SUPPLEMENTARY MATERIALS

**PREOPERATIVE ASSESSMENT**

- S** **SNORING:** Do you snore loudly (loud enough to be heard through closed doors or your bed-partner elbows you for snoring at night)?
- T** **TIRED:** Do you often feel tired, fatigued, or sleepy during the daytime (tired enough that you could fall asleep while driving)?
- O** **OBSERVED:** Has anyone observed you stop breathing or choking/gasping during your sleep?
- P** **PRESSURE:** Do you have or are you being treated for high blood pressure?
- B** **BMI:** body mass index more than 35 kg/m<sup>2</sup>?
- A** **AGE:** age older than 50 years old?
- N** **NECK:** Is it large? (measured around Adams apple)  
For male, is your shirt collar 17 inches/43 cm or larger?  
For female, is your shirt collar 16 inches/41 cm or larger?
- G** **GENDER:** male?

<5

≥5

NO

YES

**IN CASE OF ONE OR MORE OF THE FOLLOWING:**

(SIAARTI-AIMS Recommendation-2012)

- METs ≤ 4
- PATHOLOGICAL ECG
- HYPERTENSIVE/ISCHEMIC CARDIOPATHY
- SpO<sub>2</sub> < 94% AMBIENT AIR
- ASTHMA – COPD (poorly controlled), WHEEZING
- PREVIOUS DVT
- PREVIOUS PE

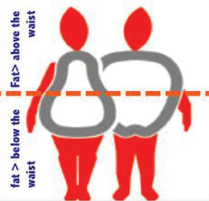
**IF NECESSARY CONSIDER:**

- ✓ Pneumological and/or Cardiological referral (GL ESA 2014)
- ✓ Echocardiogram
- ✓ ABG
- ✓ Polysomnography
- ✓ Preprocedural nCPAP

Anesthesiologist with specific competence – Expert Team  
IF major surgery: provide ↑level of assistance

**PERIPHERAL OBESITY (PEAR)**

LOWER RISK  
comorbidities



**CENTRAL OBESITY (APPLE)**

**INCREASED RISK:**

- cardiocirculatory complications / DVT-PE
- Metabolic syndrome
- Difficult ventilation
- Difficult airway

**AIRWAY SAFETY**

**STANDARD RISK INDICATORS:**

National Health Ministry «Safety in OR recommendations»  
SIAARTI airway management recommendations

+

**SPECIFIC RISK INDICATORS:**

neck circumference cm: W > 41 - M > 43  
OSA (known or suspected) – OHS  
WHR: W > 0.8 - M > 0.9

**PLAN AIRWAY STRATEGY FOR**

Difficult Ventilation or Oxygenation  
DIFFICULT LARYNGOSCOPY+ SAFE EXTUBATION

CHECK EQUIPMENT AND SKILLS  
PLAN CLINICAL ASSISTANCE PATHWAYS  
IMPROVE MULTIDISCIPLINARY APPROACH  
REGISTER DATA AND STRATEGIES ON CLINICAL DOCUMENTATION

Suitable for DS

ALWAYS Provide MAC

CONSIDER ALERT TO MODULATE LEVEL OF ASSISTANCE

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## INTRAOPERATIVE CARE

### ADDITIONAL EQUIPMENT (to be added to the standard)

- Suitable bed, chairs, trolley and operating table with specific support (for size and weight) – step for the Anesthesiologist
- Moving devices – ADEQUATE staff NUMBER for patient placement and transport
- APPROPRIATE antidecubitus /antifall devices – ADEQUATE sized gowns for patients dignity respect
- Large NIBP cuff, long needles for vascular access and/or LRA
- Ramped Position device – difficult airway devices (2<sup>nd</sup> generation SADs – VDL – FOB – bougie – tube exchanger–cricothyrotomy set)
- Monitoring: NMB – EtCO<sub>2</sub> (ALSO FOR NORA) – consider depth of anesthesia monitoring (awareness)
- Ventilator allowing controlled, assisted and spontaneous techniques with PEEP/CPAP
- Intermittent compression device for DVT prophylaxis
- ULTRASOUNDS AVAILABILITY

### RAMPED POSITION

(tragus level with-sternum)  
for induction/intubation/extubation



### ANESTHETIC MANAGEMENT

- Evaluate antiacid prophylaxis, antireflux, antiemetics and antibiotics
- Monitoring: glycemia - temperature - volemia
- Prevention of positional injuries: if possible patient self-placement on the operatory table
- Evaluate alternatives to endotracheal tube
- Plan strategy in case of difficult airway management
- Evaluate risk of analgo-sedation in spontaneous breathing
- Ramped position for preoxygenation ± THRIVE/nCPAP/NPPV in mask and for intubation
- Minimize apnea time during induction to avoid desaturation
- Pass quickly to the maintenance phase (awareness)
- Set up protective ventilation
- Privilege short-acting drugs- multimodal analgesia
- Consider deep miorisolution – NMB monitoring
- Apply safe extubation plan (including sitting position 25-30°)

Prefer MINI-INVASIVE surgical technique

### CONSIDER SPECIAL CAUTIONS IN OBESE PREGNANT PATIENT

- EARLY ANESTHESIOLOGICAL EVALUTATION
- Early epidural analgesia (ultrasound support)
- Consider the risk of “difficult lumbar access”
- LRA: is not an alternative to manage a predicted difficult airway (> VENTILATION)
- Consider AFOI

### Discharge Criteria OR – RR – PACU – NORA

STANDARD criteria	SPECIFIC criteria
Health Ministry	SpO <sub>2</sub> as close as possible to the preoperative value with minimal oxygen supplementation
Local (hospital)	
	Absence of hypoventilation (hypopnea/apnea for at least 1 hour)
	<b>ALERT</b> in case of difficult airway management



## POSTOPERATIVE SAFETY

### LEVEL OF CARE

Adjust LEVEL OF CARE (I, II, III level) to:

- Preexisting comorbidity
- Procedure complexity
- Hypo/dis/ventilation risk

ward assistance includes handover for:

- Multimodal analgesia
- Sitting position 25-30°
- Early mobilization and physiotherapy
- Appropriately extended DVT prophylaxis
- Increase attention and monitoring in case of long-acting sedatives and opioids use
- Alert criteria (NEWS model)
- Prevention and treatment of rhabdomyolysis
- Prophylaxis and control of infection



#### Precaution in case of OSA/OHS

- Keep sitting position 25-30°
- Avoid sedative and opioid
- Evaluate nasal cannula (oxygen?) – restart nCPAP if yet in preoperative use
- Monitor SpO<sub>2</sub>: untreated / not tolerating nCPAP patients using opioids
- IF critical situation, adapt assistance : ↑ at level II (with bed availability at level III)

#### AFTER DIFFICULT AIRWAY MANAGEMENT

- Supply information in clinical and anesthesiological documentation
- HANDOVER – ALERT to ward team and to patient



#### SPECIFIC ALERTS IN INTENSIVE CARE (Level III – ICU)

- Adequate team approach for difficult airway management in critically ill patient and in emergency
- Tracheotomy: timing / difficulty (percutaneous- surgical technique) / adequate cannula choice
- Protective ventilation
- Suitable resources for frequent mobilization and deubitus prevention
- Early rehabilitation
- Appropriate organization in case of secondary transport

### SPECIAL ALERTS AND WARNINGS

**ERAS PROTOCOLS** Specific attention to surgical obese patient

#### PREGNANT (CESAREAN SECTION)

“Safe birth pathways”– anesthetic ALERT and precautions in post cesarean section

#### RAPID RESPONSE SYSTEM TO INTRA-HOSPITAL EMERGENCY

Early alert criteria – organize to act  
Adequate equipment & emergency team skills



#### ALERT in ED

- Provide for supports, moving devices, equipment – suitable for patients size/weight
- Early MET ALERT for difficult airways risk: CHECK skills & devices –emergency techniques
- Specific attention for assistance during secondary transport (Ambulance/Helicopter)

